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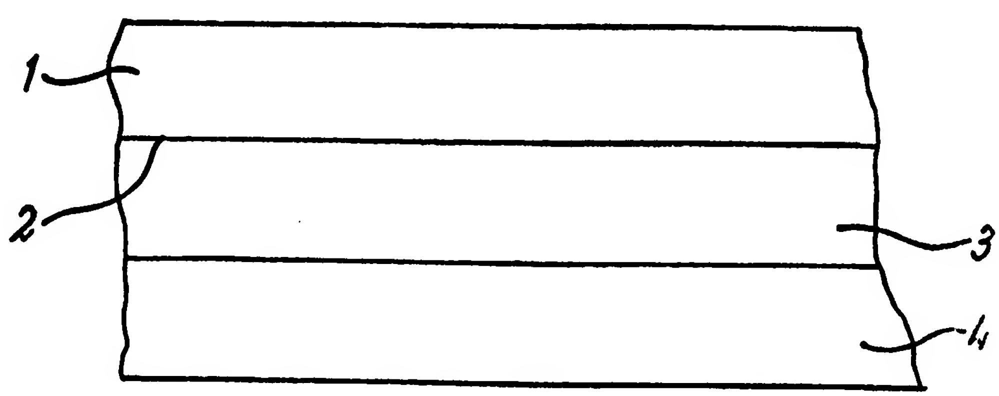
(54) Title: A METHOD OF ROTATIONAL MOULDING AND ROTATIONALLY MOULDED PRODUCTS

(57) Abstract



In a method of rotational moulding coated granules of a first moulding material are mixed with a second moulding material preferably in powdered form. During the moulding process, the coating promotes separation of the granules from the other material before being absorbed and as a result a multi-layer moulding is produced. The granules may be of a different material from the second moulding material. Specifically, the granules may contain a foaming agent to produce a foamed layer intimately attached to the other layer.

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A METHOD OF ROTATIONAL MOULDING AND ROTATIONALLY MOULDED PRODUCTS

The present invention relates to a method of rotational moulding and to rotationally moulded products produced thereby.

The method is particularly, but not exclusively, applicable to the production of a product having a solid skin with a foamed core. It is extendable to any multiple layer product. Multiple layer products have a number of uses in rotationally moulded products, for example, solid skin with a foamed core or polyethylene with a nylon barrier for permeation resistance. The method of adding the second layer can be varied but invariably involves a mechanical device (e.g. dump-box) or an extra processing step. This often renders the process uneconomic due to complexity or delay. A second layer of foam, for example, polyurethane, can also be added to a part after production.

A single step process which allows the addition and natural separation of multiple layers has been developed. In the case of foamed sections, the process involves a mixture of powdered polymer and granules/large particles which have been compounded with blowing agent. The powder sticks to the mould first and forms a solid skin with the granules sticking later and forming the second foamed layer. A process of this type is described in

Canadian Patent No. 983,226. However, there are problems with this type of process because a complete separation of the two layers cannot be reliably achieved. Typically some of the larger particles stick to the mould, foam at the surface and so flaw the solid skin.

It is an object of the embodiments of the invention to overcome this problem.

According to the present invention there is provided a method of rotational moulding including the steps of coating the granules of a granular moulding material, mixing the coated granules with a second moulding material, introducing the mixed materials into a rotational mould and moulding the materials in the mould whereby during moulding the coating promotes separation between the granular moulding material and the other moulding material so that the materials form different but adjacent layers, the coating being absorbed in the materials during moulding.

No limitation as to size, shape or consistency is intended by the use of the term granules except that the granules should be as large or larger than the largest particle size of the material in powdered form.

This promoted separation avoids the formation of surface flaws caused by granules sticking to the mould surface penetrating the layer produced by the other material and foaming in it.

The second material is advantageously in the form of a powder.

The material used in either the powder or the granules/large particles may be any polymeric material. The coating may be any material which prevents the granules from sticking to the mould or other material during processing. The coated granules may contain foaming agents to produce a foamed structure. The coated granules may be of a different material to the powder in order to produce a two phase structure. The proportions of powder to granules may be varied to alter the ratio of skin to core thickness.

The invention also comprises any moulded products produced by the above method.

In order that the invention may be more clearly understood, one embodiment thereof will now be described by way of example with reference to the single figure of the accompanying drawing which shows diagrammatically a part of a rotational mould and moulded article disposed therein.

In the method of the invention as applied to a two layer product, the granules of a granular synthetic plastics polymeric material are coated with a coating to prevent them sticking to the mould or other materials. This

coated material is mixed with another synthetic plastics polymeric material in powdered form. The granular material may be treated with a blowing agent if a foamed layer is required. Otherwise no blowing agent is necessary. The mixed materials are introduced into a rotational mould and moulded in the normal way. The powdered material migrates during moulding towards the mould surface and the granular material migrates during moulding to the interior of the mould, thus producing a two layer product where the layers are intimately attached to one another. In the drawing the mould part is referenced I and its inner surface 2. The two layers formed from the powdered and granular materials respectively are referenced 3 and 4.

The coating prevents or inhibits the granules sticking to the mould surface, where they can cause flaws in the surface of the moulded product which is the surface of the layer 3 formed from the powdered material, or to the material of the layer 3. The coating may consist of anything which will inhibit sticking. It may consist, for example, of an inorganic material such as a ceramic dust, paint or high temperature barrier. After performing its anti-stick function during moulding the coating is absorbed into the moulding materials. Absorption takes place as melting occurs or as foaming occurs when the granules have been treated with a blowing agent to produce layer 4 as a foamed layer. More than two layers may be produced

as desired. The ratio of the thicknesses of the layers may be varied by varying the amounts of materials in the respective layers. The materials in the layers may be the same or different to produce a multiphase structure. Any suitable moulding material may be used but polyethylene, polypropylene and polyvinylchloride are preferred.

Some examples of moulding mixtures and processes are as follows:-

Example I

600g of linear polyethylene granules which were pre-compounded with 1% blowing agent (diameter 2mm, length 3mm on average) were coated with a fine layer of ceramic dust. This was a 94% alumina material with an average particle size < 10 microns. These coated granules were added to 400g of standard polyethylene powder used for rotational moulding. The powder particle size was < 300 microns although material up to 500 microns has been used.

The mixture (total weight 1Kg) was placed inside a 300 x 300 x 20mm mould cavity which was then clamped shut. This was heated in an oven at 300°C until the internal temperature was 205°C (the value of this temperature will vary according to the level of foaming required).

During the moulding process, the powdered material sticks to the mould first and forms a solid layer. The coated material is prevented

from sticking until this layer is almost complete. The coated material forms a second layer, absorbing the ceramic dust and foams at the retiration point of the blowing agent (approximately 180°C in this case). The final moulded part consists of solid plastic (2.5mm), foamed core (14mm) and solid plastic (2.5mm).

Example 2:

1Kg of linear polyethylene granules containing 1% blowing agent were coated with a high temperature resistive spray. The granules were 2mm in diameter and on average 8mm long. These were then added to 0.5Kg of polyethylene powder and placed inside a mould 300 x 300 x 330mm. The mould was clamped shut and heated in an oven at 300°C. The process was again stopped at 205°C internal temperature.

During the process, powdered material formed a solid skin on the outside of the part (adjacent to the mould) and the coated granular material formed a foamed inner layer. This produced a hollow cavity within a solid skin (approximately 1mm) and a foamed lining (approximately 6mm).

It will be appreciated that the above embodiment has been described by way of example only and that many variations are possible without

departing from the scope of the invention.

CLAIMS

1. A method of rotational moulding including the steps of coating the granules of a granular moulding material, mixing the coated granules with a second moulding material, introducing the mixed materials into a rotational mould and moulding the materials in the mould whereby during moulding the coating promotes separation between the granular moulding material and the other moulding material so that the materials form different but adjacent layers, the coating being absorbed in the materials during moulding.

2. A method as claimed in claim l, in which the second moulding material is in powdered form.

3. A method as claimed in claim l or 2, in which the granular moulding material is foamable.

4. A method as claimed in claim 3, in which the granular moulding material is treated with a blowing agent to make it foamable.

5. A method as claimed in any preceding claim, in which one of the moulding materials is polymeric.

6. A method as claimed in any preceding claim, in which both of the moulding materials are polymeric.

7. A method as claimed in claim 5 or 6, in which the polymeric material is polyethylene, polypropylene or polyvinylchloride.

8. A method as claimed in any preceding claim, in which the granules are

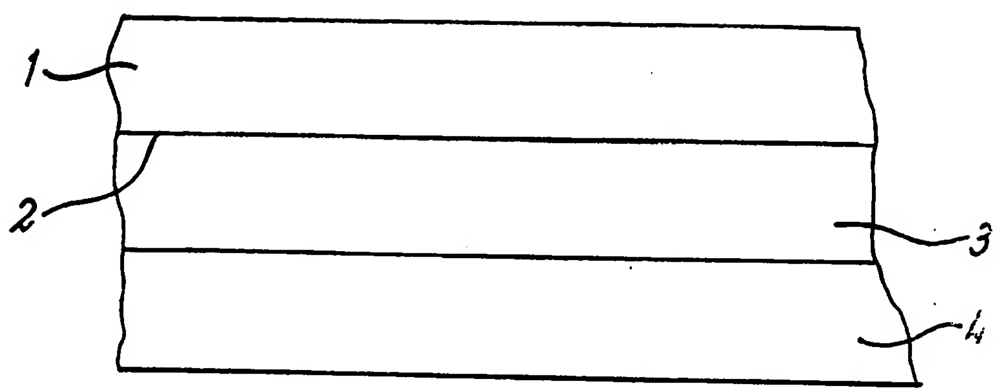
8. A method as claimed in any preceding claim, in which the granules are coated with an inorganic material.

9. A method as claimed in claim 8, in which the inorganic material is a ceramic dust, paint or high temperature barrier.

10. A method as claimed in claim 9, in which the ceramic dust is a 94% alumina material with an average particle size less than ten microns.

11. A method of moulding as claimed in claim 1 and in accordance with Example 1 or Example 2.

12. A moulded product produced by the method of any of claims 1 to 11.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